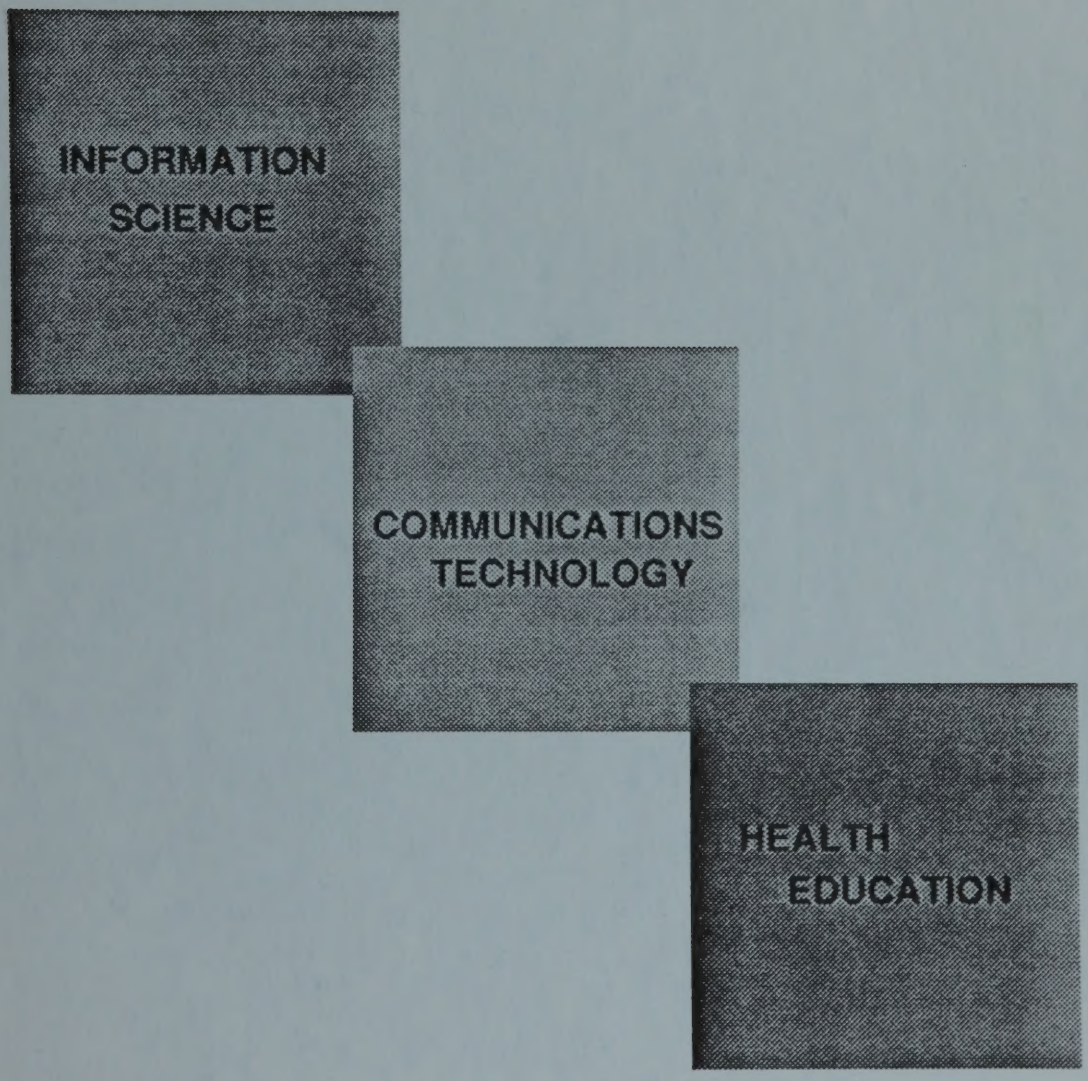
LISTER HILL NATIONAL CENTER FOR BIOMEDICAL COMMUNICATIONS

********** *R&D PROGRAMS* **********

1986



NATIONAL LIBRARY OF MEDICINE

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LISTER HILL NATIONAL CENTER FOR BIOMEDICAL COMMUNICATIONS

R&D PROGRAMS

1986

NATIONAL LIBRARY OF MEDICINE

8600 Rockville Pike

Bethesda, Maryland 20894

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LISTER HILL NATIONAL CENTER FOR BIOMEDICAL COMMUNICATIONS

I. INTRODUCTION

The Lister Hill National Center for Biomedical Communications (LHNCBC) was founded in 1968 to explore the application of information and communications technology to solve problems in the health care professions and to improve systems for collecting and processing biomedical information and distributing it to the research and practicing communities. The Center is presently investigating ways to use modern technology in Library Science, medical education, health care delivery and continuing education programs to keep health care professionals abreast of current developments in their field. In 1983 the Center was merged with the National Medical Audiovisual Center and expanded its interest, staff and facilities in educational and multi-media areas of technology.

To insure the evolution of quality research at the Center, intramural projects are regularly reviewed by the NLM's Board of Scientific Counselors, an advisory committee of research scientists and professionals qualified to comment and advise on the quality and appropriateness of intramural research efforts. The Board reviews are submitted to the scientific leadership of the NIH and conform to policy requirements of NIH, HHS, and the Congress. The process is similar to those followed by other Boards which review the intramural programs of the NIH research institutes and divisions with adjustments which take into account the nature of the LHNCBC/NLM research program.

II. ORGANIZATION

The Lister Hill Center is the intramural research division of The National Library of Medicine and is administratively organized into an Office of the Director and six branches: Computer Science Branch; Health Professions Applications Branch; Information Technology Branch; Communications Engineering Branch; Audiovisual Program Development Branch; Training and Consultation Branch.

Each Branch provides a focus for developing and managing R&D program and laboratory facilities. R&D programs and projects often involve a combination of professional disciplines and are conducted on a center wide basis with staff from several branches participating.

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III. RESEARCH AND DEVELOPMENT

A. Electronic Image Processing

The focus of this research area is electronic imaging technology in the capture, storage, processing, online retrieval, transmission and display of biomedical documents and medical imagery. Research areas include image compression, image enhancement, image understanding, pseudo-gray scale rendition, omnifont text recognition, 3-D reconstruction of biomedical imagery, and man-machine interface design. Research into imaging techniques that support medical educational packages employing digitized radiographic and other imagery are also included.

Electronic Document Storage and Retrieval

G. Thoma, F. Walker, J. Cookson, S. Hauser, T. Harris

The objective of this research program is to investigate the role of image information systems and technology in document preservation, online document delivery, user access to the biomedical literature, and library information processing activities.

A laboratory facility has been developed for investigating the role of electronic document storage and retrieval (EDSR) in library information processing activities. The facility is an integrated system that includes document capture devices for both loose-leaf pages as well as bound volumes, magnetic buffer storage, digital optical disc drives, high resolution softcopy (CRT) displays rendering a legible bit-mapped image of a full page of a book or journal, modules for dynamic thresholding and pseudo-halftoning, high speed digital image transmission subsystems, and modules for image enhancement and manipulation. A system controller has been designed and implemented to control the basic functions of capturing the document images, transferring them to magnetic and optical disk storage, retrieving them in conjunction with bibliographic (citation) databases, and displaying them at high-resolution work stations.

At present the facility is used as a laboratory testbed to answer key questions regarding the role of EDSR technology in the preservation of NLM's document collection. Especially important are issues related to image quality, document throughput rate, costs of conversion, appropriate image processing functions, longevity and reproducibility of the stored image data, effectiveness of the man-machine interface, and effects of system architecture on online access to the stored documents.

The progress to date includes error performance in document image transfer to digital optical disks, image transfer rates, and transfer rate performance analysis, and effects of real-time pre-processing on image compression ratio.

Future research and development efforts include the following:

Experiments in the application of image information systems for online document delivery.

Investigation of man-machine interface (MMI) issues in user access to a biomedical document image database. Examples of such issues include MMI software design, menu design, and synthetic voice.

Investigation of image processing algorithms and issues related to hardware implementation. Examples include image compression, enhancement, manipulation, symbol isolation, feature extraction, image segmentation, and other processing functions.

Video Imaging Systems
E. Henderson

The purpose of this area of R&D is the development and evaluation of improved cost effective techniques to capture, store and display medical images for computer based medical education systems. Techniques presently being implemented and evaluated include the use of digital capture and encoding of medical images to improve the signal-to-noise ratio and the use of windowing techniques to provide high resolution images in video format on standard NTSC systems. Compared to analog systems, these techniques provide improved image quality on low cost personal computer work stations.

Image processing techniques are also being explored to isolate and display localized regions of interest on the digitized radiographic images.

A prototype system has been developed using an IBM AT controlling a frame grabber substem and a CDROM storage unit. Further studies will include the technical and operational evaluation of this system in simulated educational environments.

B. Knowledge Based Information Systems

Automatic Classification and Retrieval
A. McCray, J. Aronson, S. Humphrey

The objectives of this research program are to conduct basic and applied research which will lead to the development of automated systems for identifying, representing, and retrieving relevant information from medical documents.

Each year, expert indexers at the National Library of Medicine index and add approximately 300,000 citations to MEDLINE, NLM's computerized bibliographic database. Access to MEDLINE is available at nearly 3,000 locations across the country. The Automated Classification and Retrieval program is concerned with exploring research areas that will ultimately aid both in the indexing and retrieval of this vast amount of information. Accordingly, work is being pursued intramurally and extramurally in two major AI research areas, knowledge representation and natural language processing.

Work in natural language processing addresses questions of parsing strategies, grammar formalisms, and dictionary structure, as well as increasing the capability of a system to understand more and more natural language input. This latter requires extensive work in building the syntactic, semantic and lexical components of a system. We are presently initiating work in this area. A testbed for our work in natural language understanding will be provided by abstracts to journal articles in biomedicine.

Indexing Aid

S. Humphrey, N. Miller

The purpose of this project is to develop and test an interactive knowledge-based system for computer-assisted indexing and thereby investigate computer-encoded knowledge representation schemes and artificial intelligence techniques for automating the classification and retrieval of the periodical medical literature.

Specifically, the objectives of the project are [1] development of a system that uses a knowledge representation scheme to index the same sorts of entities as NLM's operational MEDLINE system, except that the Indexing Aid System will produce document-specific representation frames that explicitly express relationships between the indexable entities, and [2] using rules associated with the knowledge-based indexing scheme, generation of keyword indices which will provide a basis for comparison with the MEDLINE system.

The knowledge base consists of frame data structures, and the System is written in a Lisp-based experimental knowledge representation language, FrameKit, developed at Carnegie-Mellon University, and an extension package based on this language. An initial prototype has been developed which operates on NLM's VAX 11/780 minicomputer under the Unix BSD 4.2 operating system. The University of Maryland Window Package has been adapted for the user interface. We are currently developing and expanding the knowledge base and designing computer programs to implement the new rules in order to prepare the System for testing.

The Project lends itself to research in the following areas: knowledge representation languages, indexing (cognitive process, indexing rules), retrieval from representation frames, indexer- and

searcher-computer interfaces, interface with natural language understanding programs to further assist indexers and searchers, automatic text generation from representation frames, automatic updating of knowledge bases (machine learning), and database design for System implementation (scaling up).

Thesaurus Building
R. Rada, G. Letourneau, J. Malina

Our research concerns the intersection of Artificial Intelligence (AI) and Information Retrieval (IR) - particularly as those areas apply to thesaurus construction. We see a relationship between the represent, reason, and learn components of AI and the thesauri, match or parse, and augment components of IR as follows:

i) represent -- thesauri

ii) reason -- match or parse

iii) learn -- augment.

Our strategy for augmenting thesauri depends on first finding a similarity between two existing thesauri and then adding a part of the one thesaurus to the other at the point of similarity. We have done such augmentations by adding relationships or edges from CMIT to MeSH and by adding terms from SNOMED to MeSH. For an instance of adding an edge, CMIT notes that granuloma are a pathological aspect of rheumatoid arthritis but MeSH doesn't; so in our experiments an edge is added to MeSH between rheumatoid arthritis and granuloma. As an instance of adding a term, SNOMED has the term Rickettsia canada as a child of Rickettsia but MeSH doesn't; so in our experiments, the term Rickettsia canada becomes and instance of Rickettsia in MeSH.

To test our augmentation strategies we implement matching and parsing algorithms. Our matcher has shown itself capable of simulating people in the cognitively meaningful task of ranking documents for their relevance against a query. The parser we are testing is ideally suited to the domain of the library in which millions of documents exist on the computer which already have been hand-parsed by people.

C. Expert Systems
L. Kingsland, M. Cheh, K. Grant

Expert systems are computer programs combining knowledge of a subject matter area with inferencing mechanisms which enable them to use this knowledge in problem solving situations. Our research focuses on expert systems in the biomedical domain. The objective of this work is to study issues in the development of knowledge-based consultant systems to bring specialist expertise to clinicians not having ready access to human experts.

We have developed the AI/RHEUM consultant system in rheumatology, one of the largest medical artificial intelligence systems in the world. The AI/RHEUM diagnostic component reasons from a patient data checklist of 877 findings through 467 intermediate hypotheses to 26 disease conclusions. AI/RHEUM has been tested with 517 cases to date, agreeing with a consensus diagnosis of rheumatologist clinicians more than 90% of the time. A multi-site validation process is being planned for the diagnostic system, after which it will be placed in the public domain. A more recent development, the AI/RHEUM patient management system, offers therapy recommendations for cases of rheumatoid arthritis.

Another system known as AI/COAG offers diagnostic assistance in problems of hemostasis. Human specialists in blood clotting disorders are relatively rare and are often clustered in large cities and in tertiary care medical centers. The AI/COAG hemostasis consultant system interprets coagulation laboratory screening tests and acquires and analyzes a detailed bleeding history, helping the physician to decide whether a comprehensive workup is necessary. A third AI/COAG system module advises emergency room physicians on blood component therapy for cases of major trauma.

Additional systems have been proposed in pediatric radiology, in neurology, and in the management of chemical spills and hazardous substances emergencies. Of particular interest to the Expert Systems Program investigators are issues in human factors design for expert systems, in high-resolution graphics as an adjunct in illustrating system reasoning, in interactive videodisc capability to extend system utility and educational potential, and in high-performance microcomputers as delivery vehicles for these large, complex programs.

To that end, we have ported EXPERT, a general-purpose software framework for building expert consultant systems, to the IBM PC AT. EXPERT was developed at Rutgers by Kulikowski and Weiss, valued collaborators on the AI/RHEUM project. We are using the AI version of EXPERT as a testbed for working with the mouse pointing device, enhanced color graphics, and interactive videodiscs in new systems.

Computer facilities available to us include the SUMEX-AIM research resource computers at Stanford and Rutgers, the Lister Hill Center VAX-11/780's, Xerox and Tektronix AI workstations, an AT&T 7300 Unix PC, a MicroVax II and individual PC AT's.

D. Information Retrieval

Online Reference Works

C. Goldstein, D. Benson, L. Fitzpatrick, D. Williamson,
R. Huntzinger, M. Prettyman

The Online Reference Works (ORW) program addresses the general problem area of information retrieval from existing published, medical reference literature. A goal of the program is to provide

efficient, low-cost retrieval systems without the need to create specially structured knowledge bases. An allied research area is the definition and development of an electronic authoring environment to facilitate the preparation and revision of reference works and related scholarly texts. Particularly with the introduction of high-density storage devices, such as optical disks, and of powerful workstation hardware, it is feasible to envision a "scholar's workstation" that could serve both the student and author as an integrated information resource.

The objective of the retrieval side of the ORW program is to provide a systematic evaluation of retrieval methodologies and guidelines for the selection of strategies for particular text databases. Collaboration with an active user community is a key component for the evaluation of retrieval systems in operational settings and for acquiring feedback on actual user needs. Currently collaborative work is underway with the Johns Hopkins School of Medicine in the evaluation of a retrieval system for human genetics information which was developed under the ORW program.

A second objective is to develop an integrated interface for linking related texts in a given subject domain so that users can transparently access a variety of information sources within a single system. Information sources would include not only related texts but online databases and videodisc-based visuals.

A third objective is to define procedures, techniques, and tools that can assist in the online preparation of scholarly text. Revision control, bibliographic management, and multi-author environments are some of the areas in which work is progressing.

The study of retrieval strategies has been based upon the development of an information retrieval testbed named IRX (Information Retrieval Experiment). IRX offers a modular, extensible system for testing and evaluation as well as serving as the foundation of an interactive user retrieval system. IRX is written in the C language and runs on a variety of hardware from VAXs to PCs. IRX has been used to conduct experiments in measuring retrieval effectiveness of ranking algorithms, word stemming, and the use of thesauri. An interactive retrieval system OMIM (Online Mendelian Inheritance in Man) has been implemented for the user evaluation of the retrieval techniques developed under IRX in a clinical and library environment. A preliminary set of authoring tools have been developed for online text preparation and are in actual use for the production of the next edition of Mendelian Inheritance in Man. The linkage of related databases has begun with work on incorporating the human gene map and a set of clinical synopses in the MIM text.

The information retrieval part of the ORW program has both short-term and long-term objectives. For the short-term, statistically-based retrieval techniques hold the most promise for the development of low-cost systems with adequate retrieval

performance. Thus, at present, concentration is being placed on deriving optimal cost-performance tradeoffs for statistical methods. The immediate objectives are to include thesauri and linked data, both textual and visual, into the ranking and stemming algorithms that have been tested and evaluated. It is planned to integrate the software into a system that can serve as a "scholar's workstation" which would include optical disk storage, a high-resolution display, and network access. It is anticipated that higher levels of performance will demand the more sophisticated query processing and text retrieval techniques that are found in AI systems. Consequently, AI tools as syntactic parsers, natural language front-ends, and frame-based indexing methods will be incorporated into the later stages of the project.

Dermatologic Visual Data Base

C. Sneiderman, R. Gregg

The purpose of this project is to explore the role of visual information in performing and learning medical diagnosis. To date this project has investigated the application of microcomputer and videodisc technology in archiving, assembly, indexing, and retrieval with visual databases in the content area of skin diseases.

Project activities have included:

- Development of a pilot microcomputer-videodisc diagnostic system to demonstrate the feasibility of the technology.

- Development of a pilot laser videodisc that contains recorded images of common dermatoses (developed in collaboration with local dermatologists.)

- Development of a pilot laser videodisc of exemplary skin lesions (developed in collaboration with the American Academy of Dermatology.)

Future activities:

- To evaluate videodisc image utility empirically, employing clinician and student decisions as criteria.

- To develop a dermatologic thesaurus and lexicon for indexing and retrieval of visual and textual information.

- To prepare a videodisc of clinical and histopathologic images to support a national melanoma database project.

E. Bibliometrics

Library Growth Research

W. Seibert, M. Kuenz, R. Gregg

The growth rates of libraries, especially of academic and research libraries, have been a concern of many librarians since Fremont Rider published his 1944 book, The Scholar and the Future of the Research Library, showing that library collections grow exponentially, typically doubling in size about every 16 years. Following Rider and beginning in 1965, a series of "Purdue Studies" by Dunn, Seibert, Scheuneman and others confirmed the outlines of Rider's findings, showing that, on the average, research library collections were doubling in 17 years. Most recently, Seibert's brief update of the Purdue and Rider studies (J. Acad. Librarianship, March 1985) has shown that, in several respects, exponential growth continued throughout the 1970's, in spite of budget constraints and other problems that many libraries have reported.

At Lister Hill Center current library growth studies are examining trends in four major groups of research and medical libraries: 1) Fifty-eight "old" academic members of the Association of Research Libraries (ARL); 2) About 35-45 "new" academic ARL members in the U.S. and Canada; 3) About 10-12 autonomous or national ARL member libraries, including NLM; and 4) About 125-135 medical school libraries in the U.S. and Canada. The available data are annual statistics that cover time periods which range from 7-8 years in group 4 to 34-35 years in group 1; they include several categories of library collection, acquisition, staffing, and budget statistics.

Current and projected studies of these data include:

1) An update and validation of the forecasts and other analyses presented in the "Purdue studies", a nine-year series of statistical reports, last published in 1973.

2) Analyses of growth trends reflected in the 35-45 "new" academic ARL members.

3) Analyses of NLM growth and comparisons with other similar libraries (e.g., other non-academic, other medical, other science technology oriented libraries).

4) Analyses of growth trends in medical school libraries and comparisons with other academic and non-academic libraries.

5) Exploratory studies to devise and test new or refined library forecasting methods.

6) Exploratory studies to determine whether the statistical behavior of libraries can serve to identify clusters of libraries that have similar "personalities" or "temperaments."

7) Studies to identify trends related to the adoption and use of library automation and technology and to assess future effects on libraries.

In several respects, the studies reported by Rider, Purdue, and Seibert show that library collection and budget statistics have increased dramatically and fairly predictably over time. For example, library collections that averaged about .89 million volumes in 1951 are estimated at 3.25 or 3.3 million in 1986 (at this writing, accurate 1986 data are not yet available). Similarly, library budgets that averaged $.46 million in 1951 should be about $11.4 or $11.5 million in 1986.

The challenge now is to determine whether trends that were established in the past are likely to continue in the future, factors that initiate or influence new trends that may emerge, and the likely effects of technology on developments in "the library of the future."

Online Systems Data Project

S. Valley

Design and develop a research database that describes online biomedical databases and their associated hardware and software, as developed in the U.S. during a ten year period, 1974-1984. Analyses of trends will be conducted that utilize this research database.

The National Library of Medicine (NLM) is a trend setter in the design, development, operation and distribution of online biomedical files utilized nationally and internationally. Utilizing the published literature, this investigator is designing and developing a research database to analyze trends in the development of biomedical databases to assist health care delivery.

The research proposal was developed and approved, a preliminary data structure was developed, and relevant articles were selected by screening NLM online files and (SCAMC) Symposium on Computer Applications in Medical Care proceedings. Data extracted was formatted into the proposed data format and entered into my personal Apple IIe. The selected Apple IIe printouts were provided to and discussed with various NLM staff. Consultation and collaboration with staff experts in several disciplines resulted in improved data organization and definition of a suitable hardware/software configuration.

The selected hardware, an IBM PC, will be fully checked out using special software, and this will be followed by installation and testing of the system to create, maintain and analyze the research database. A sample set of data will be entered into a preliminary draft file structure and a period of fine tuning will be undertaken to refine file structure and test analytical procedures. Once a suitable system is in place, a major data acquisition phase will be

undertaken. As a sufficient body of data is amassed, analyses will be conducted leading to the preparation of interim reports and publications.

F. Computer Based Education

Computer Assisted Curriculum Delivery
J. W. Woods, R. Moore, R. W. Gregg

Research is focused on the design and trial implementation of self-instructional and testing materials using microcomputers and optical videodiscs. In particular, we seek to develop an improved learning environment suited to conditions in which pictorial information (photomicrographs, radiographs, etc.) is crucial to problem solving. The factors or features being studied include programming languages and systems, input devices, devices to overlay pictures retrieved from videodisc and computer-generated text graphics, or resolution requirements for pictures stored on analog and digital videodiscs.

Classical computer-assisted instruction (CAI) has used menu-driven lessons that forced learners to choose from a list, using a keyboard. Not only does this strategy cue the learner, it presents only a limited range of choices. We have demonstrated a prototype free-text interface to a menu-driven program and are seeking to extend the use of this prototype to lessons written with other programming languages and systems. Although touch panels have seen long use in CAI, they have some disadvantages related to cost and resolution. We have investigated the use of the lightpen and "mouse" for those situations in which a learner must interact with a picture by pointing to anatomical features, fracture lines, lesions, etc. Further work remains to be done with other input devices (track ball, joystick, and new high resolution touch panels.

We have used and studied three devices for mixing analog video from the videodisc and TTL video from computers. Two are devices which output both digital (TTL) RGB video and NTSC video and rely upon a special monitor to mix the two video signals. The third puts out a single analog RGB video signal which is compatible with any analog RGB display device. All three devices have been used in radiology, anatomy, and orthopaedic surgery lessons developed here. Further investigation is required to determine which device is best suited to medical education.

In early work, we determined that the pictorial resolution provided by currently available analog optical videodisc is sufficient for presentation of photomicrographs to teach basic pathology and to use for some radiographic presentations. It became obvious in 1985 that digital rather than analog images are required for most radiologic image presentations and this is assumed to be true for other image types (hematologic, some electron micrographs, etc.). Current research is directed toward defining better the

requirements for presenting different types of medical images in learning situations.

Technological Innovations in Medical Education (TIME)

W. Harless, M. Zier

The TIME Project of LHNCBC is a research and development effort concerned with the effective utilization of interactive videodisc, voice recognition and microprocessor technology for training medical students through simulated patient encounters. The research focus is on methods of interactivity using voice recognition and the creation of realistic medical case studies using videodiscs controlled by microprocessors. These interactive case studies are designed to allow faculty to incorporate contextual instruction and discovery learning as a part of their teaching strategy in the classroom. Also, medical students are able to practice clinical decision making earlier in their training.

The purpose of the project is to integrate medical education with the clinical process and illustrate a method for maintaining a patient orientation while teaching medical facts, concepts and clinical decision making.

Specifically, the TIME project is asking the following research questions:

1. Can the new technology support the current trends in medical education toward self-directed, problem-oriented learning?

2. Does the TIME interactive case study model provide an effective educational strategy for medical students to learn medical concepts in the context of patient situations?

3. Is the TIME interactive case study model useful and effective as:
a. an independent learning environment for medical students;
b. a resource to aid faculty teaching;
c. a continuing educational strategy for practicing physicians;
d. an evaluation method for measuring clinical competence and non-cognitive characteristics of physicians?

4. Can the development of high quality TIME interactive case studies be systematized and the cost justified so that individual medical schools can take advantage of such educational materials?

The project received an Outstanding Presentation award from the American Association for Medical Systems and Informatics (AAMSI) Conference in San Francisco in May, 1985, and is co-winner of the 1985 Best Educational Achievement award from the Nebraska Videodisc Design/Production Group. The Project's prototype model (The Case of Frank Hall) has been presented as the keynote address at four major educational technology conferences during the past year.

Three TIME interactive case studies will be completed and used in the introduction to clinical medicine classroom of five selected medical schools during the next 12 months. The first will be the presentation of "The Case of Frank Hall" to the second year medical school class at Georgetown University. The topic of that presentation is gastroenterology. The presentation will be made by Dr. James Lewis, Assistant Professor of Medicine, Division of Gastroenterology, Georgetown University School of Medicine, with the assistance of Dr. William Harless, the TIME Project Director.

Following the Georgetown presentation, "The Case of Frank Hall" will be presented in the Introduction to Clinical Medicine classroom of four or five other schools, including the University of Miami, University of Missouri and the University of Cincinnati. Three TIME interactive case studies involving obesity, geriatrics and sickle cell anemia will become a part of the curriculum offerings at these schools while other schools will be selected and included as participants in the field testing of the interactive case study approach.

Appropriate evaluative strategies and instruments are being developed to determine the educational effectiveness of the materials and answer the research questions mentioned above.

National Learning Demonstration Center

C. Goldstein, M. Weisberg, V. Carr, C. Locatis, J. Starkweather

The National Learning Demonstration Center (NLDC) opened in March 1985 as a central location where various computer-video information and educational technologies are demonstrated, reviewed, and evaluated. The recent Association of American Medical Colleges General Professional Education of the Physician (GPEP) report emphasized the need to effectively exploit new technology in the service of medical education. Staff of the NLDC address this need by providing visibility to effective applications of technology. The NLDC may also serve as a laboratory where visiting scholars can spend extended periods of time exploring comparative applications and developing evaluation methods for assessing the impact of specific technologies.

The NLDC staff presently assist visitors in a variety of ways. Individual or small group tutorials are provided depending on the interests, needs, and time commitment of visitors. Tutorials range from a general overview of computer-based and video educational/information systems in the health professions to self-tutorials and hands-on experience with individual systems. Demonstrations are also provided to illustrate the diversity among system attributes and the alternatives available for courseware design and delivery.

Exhibits presently available in the NLDC represent examples of education and information technologies developed by staff of the LHNCBC, by individuals at other institutions, and by private companies. Currently exhibits are organized in five categories:

- o HEALTH SCIENCE EDUCATION AND INFORMATION NETWORKS
- o STANDALONE MICROCOMPUTER COURSEWARE
- o INTERACTIVE VIDEODISCS
- o COURSEWARE AUTHORING TOOLS
- o KNOWLEDGE-BASED INFORMATION SYSTEMS

Innovative applications of technology are continually being researched and acquired.

IV. FACILITIES AND LOCATION

A. Lister Hill Center Building

The Lister Hill Center Building is located adjacent to the National Library of Medicine facing Center Drive in the southeast corner of the campus of the National Institutes of Health in Bethesda, Maryland.

The Lister Hill Center includes special facilities, laboratories and an auditorium with modern presentation and display facilities.

B. Engineering Laboratories

A complex of engineering laboratories are located on the 10th floor of the Lister Hill Center Building.

Signal Processing Laboratory

The Signal Processing Laboratory houses experimental systems to electro-optically capture images of documents and to store them on magnetic and digital optical disk media. These bit-mapped images may be retrieved automatically and displayed on high resolution softcopy and hardcopy devices.

Specific equipment capability includes high performance scanners using charge coupled devices, magnetic and optical storage media, laser-based printer/plotters, high resolution raster-scanned CRT devices for softcopy (electronic) images. While self contained, the facility is also linked to the NLM mainframe computer resource (IBM 370-3033) and LHNCBC research and development computer resources VAX (11-780's). The laboratory primarily supports experiments in document capture techniques, image enhancement and manipulation, high density storage and image indexing on optical disk media, and related investigations.

Image Processing Laboratory

The Image Processing Laboratory includes computer and image processing equipment to process and display digital electronic images. Among the equipment in this laboratory are a PDP 11/44 minicomputer hosting a Gould DeAnza IP8500 image processing system. The laboratory supports the investigation of image processing techniques for biomedical imagery and digitized document images.

Communications Laboratory

The Communications Laboratory is equipped with distribution and processing equipment for video and digitized images. The laboratory supports the development and evaluation of experimental high-speed digital transmission interfaces.

C. Microcomputer Research and Development Laboratory

The ninth floor of the LHC houses the microcomputer research and development complex. The complex consists of a central laboratory and two ancillary rooms. It provides efficient support to research and development activities which share many common threads such as microcomputer hardware, videodisc, CDROM, and equivalent software development environments.

The laboratory is subdivided into six areas. Two of these areas provide core resources support, the remaining areas are allocated to approved research and development programs. The core areas provide a software library/archive and a communications shared equipment area. The communications section provides RS232 and video patch panels and dialout/autoanswer modems. A high speed lineprinter and variety of videodisc players are shared via the patch panels. The research program areas currently support efforts in computer based education, artificial intelligence and integrated information systems, also conduct research activity in the laboratory.

The ancillary area provides a general microcomputer access area; provides equipment available to all members of LHNCBC who have occasional or intermittent needs. Special equipment exists to facilitate the development of presentation materials, slides, viewgraphs, etc.

D. Computer Systems Laboratory

The computer systems laboratory on the eighth floor serves as a resource for the conduct of information retrieval, expert-systems, and natural language understanding research and development activities. The basic computer resource consists of two VAX 11/780 systems interconnected by an Ethernet local area network. One of the systems is connected to the ARPA/MILNET network. As a consequence of TCP/ICP network protocols either system has the capability for exchanging mail or files and or remote terminal connections with many research sites throughout the United States. The Ethernet network provides resource sharing among the VAX systems and several UNIX workstations. A broadband network is used for terminal access to the computer resource from offices throughout the Lister Hill Center. The computer resource runs under the UNIX operating system (4.2 BSD) and supports a variety of general software development tools as well as specialized facilities for research in artificial intelligence and information retrieval.

The text editors, EMACS and VI, are full-screen text editors and provide the capability of editing programs and documents. EMACS, through its macro language feature (a Lisp-like dialect), can be tailored to fit a multitude of applications ranging from document preparation to program development. Document preparation is facilitated by text formatting packages that can provide near photo-typeset quality output. The graphics facilities include a

high resolution laser printer, bit-mapped display terminals and software which supports a multiple-window capability.

The artificial intelligence languages and tools include the languages Interlisp, Franzlisp, and Prolog; and the expert system building tools, AGE, EMYCIN, MRS, AND EXPERT, and natural language parsers such as RUS, DYPAR, and FIDDITCH. Data base management facilities are provided by a Britten-Lee IDM database machine and SIRE which is a text based system.

E. Training and Demonstration Facilities

A major demonstration facility within the LHNCBC itself is the National Learning Demonstration Center discussed above as a mission related technology demonstration activity in the field of health sciences education and services support.

The NLDC occupies room B1N30D on the B1 level of the Lister Hill Center Building. It has thirteen carrels, a reception center, and a small conference area. The carrels are modular and can easily be reconfigured or augmented as requirements change.

Exhibits presently available in the NLDC represent examples of education and information technologies developed by staff of the LHNCBC, by individuals at other institutions, and by private companies. Plans are being developed to expand demonstration activities to a larger area adjacent to the current NLDC. When this expansion is completed, the smaller area will be used for individual work and study, while the larger area will serve as the central point for public access.

The LHNCBC has a variety of conference and demonstration facilities available many with projection of video, text, film, and still images. A 150 seat auditorium, a 50 seat classroom, a 28 seat screening facility, a 25 person computer demonstration facility, as well as other conference and meeting rooms.

F. Multi-media Technology Laboratory

The multi-media technology laboratory resources allow the capture, and editing of motion, still, microscopic, electronic, and photographic images. Images can be processed, enhanced, still stored and retrieved. Current technological emphasis is being placed on developing techniques for supporting efficient, effective, and technically appropriate premastering for videodisc development. These capabilities are an important part of LHNCBC research and development efforts in computer based education projects. A new capability is the video animation system which allows the creation and capture of animated graphic images.

V. COLLABORATING UNIVERSITY, PROFESSIONAL, AND COMMERCIAL ORGANIZATIONS

The Lister Hill National Center for Biomedical Communications has collaborated with many academic, disciplinary, professional and commercial organizations in carrying out its research and development programs and individual research projects. Some of the current organizations that are providing technical, academic, professional, or other resources toward the accomplishment of LHNCBC research objectives are:

Academic

Carnegie-Mellon University
Duke University
Georgetown University
George Washington University
Howard University
Johns Hopkins University
University of Maryland
Pennsylvania State University
Rutgers, The State University of New Jersey

Professional

American Academy of Dermatology
American Academy of Orthopaedic Surgeons
American College of Radiology Institute
American Suicidology Association
Association of Research Libraries

Commercial

Bendix Field Engineering Corporation
IDEAS, Inc.
Management Systems Designers, Inc.
ONLINE COMPUTER SYSTEMS, Inc.
RCA Services Corporation